

Comparative Landscape Photographs of the Lonely Dell Area and the Mouth of the Paria River

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Prepared in cooperation with the National Park Service



Upstream north-northwest-facing view of Paria Canyon; Paria Plateau on left skyline

Pamphlet to accompany
Geologic Investigations Series I-2771

2003

U.S. Department of the Interior
U.S. Geological Survey

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Panorama of the Paria Canyon Upstream from Lonely Dell Ranch



1872

A



B



May 25, 1992

A



B

Photograph site 1.

1872, A. In this first of four photographs in a panorama from south to north, William A. Bell of the Wheeler Expedition photographed the geology of the Paria Canyon and the Lonely Dell reach of the Paria River. This view in the panorama faces southwest across the Paria River into a tributary canyon. This channel appears barren, as if a recent flood had scoured sediments from the bed and banks. The Paria River is barely discernable, with only two small cottonwood trees (*Populus fremontii*) visible on the right bank. The photographs must have been taken during the winter months because the cottonwoods are leafless. **May 25, 1992, A.** The tributary channel is distinct in the 1872 image but is obscured by shrubs in the 1992 image. The low cutbank in the lower right was incised after 1872 and before deposition of the modern alluvium. The modern terrace (unit mt) of the Paria River is covered with willow (*Salix exigua*), native shrubs, and tamarisk (*Tamarix* sp.), a non-native species that was introduced into the watershed about the time this photograph was taken. The cottonwoods have disappeared from the view. Saltbushes (*Atriplex confertifolia* and *A. canescens*) and snakeweed (*Gutierrezia sarothrae*) appear on the midground terraces and modern terrace (unit mt). Several large cobbles remain in the foreground. **1872, B.** Of the four views, the Paria River channel is least obstructed by the Pleistocene terrace (unit gvc) in this view to the west-southwest. A wagon track, probably used by John D. Lee, appears on the settlement-age floodplain on the lower left. Scattered, leafless cottonwoods occupy both banks; the dark trees appear to be junipers (*Juniperus osteosperma*). The right channel margin has a steep, nearly vertical bank of perhaps 0.6 to 1.0 m high. **May 25, 1992, B.** The geological formations shown in the 1872 photograph appear more subdued and rounded in this view because of cloud cover. The steep slopes of the Pleistocene terrace have eroded, removing many of the rocks that were perched

Panorama of the Paria Canyon Upstream from Lonely Dell Ranch—Continued



1872

C



D



May 25, 1992

C



D

Photograph site 1.—Continued

there. In the lower left, the modern terrace (unit mt) has replaced the former settlement-age floodplain. The original cottonwoods are gone from the view, replaced by tamarisk and willows with scattered native shrubs; one cottonwood appears in the lower center. An irrigation ditch was constructed after 1872 above the right bank (facing downstream). **1872, C.** In this view of the panorama, Bell captures details of the Pleistocene terrace (unit gvc) in the foreground, a small portion of the Paria River in the middle, and the cliffs at the base of the Paria Plateau in the background. The view is to the west-northwest. Small cottonwood trees line the channel of the Paria River at the center and large shrubs, possibly greasewood (*Sarcobatus vermiculatus*) dot the settlement-age floodplain. **May 25, 1992, C.** Although some of the rocks on the foreground terrace have slid downslope, many are in the same place. The cottonwoods are gone and tamarisk and willow are scattered on the modern terrace (unit mt). **1872, D.** This view toward the north-northwest shows the channel of the Paria River upstream from the Lonely Dell Ranch and the Pleistocene terrace (unit gvc) on the east side of the channel. Scattered shrubs, most of which are shadscale (*Atriplex confertifolia*), are on the surface of the terrace. In the middle distance looking over the terrace in the foreground, the Paria River is lined with small cottonwood trees. **May 25, 1992, D.** In the foreground, some rocks on the top and sides of the Pleistocene terrace (unit gvc) remain in the same place, as well as some shrubs that have persisted despite heavy grazing in the area in the intervening 120 years. The riparian vegetation along the channel in the distance is now mostly tamarisk. Cottonwoods are no longer present in this view, although they remain in this reach. (1872 photographs by William A. Bell, courtesy of the National Archives, 280, 353, 265, 267; May 25, 1992 photographs by Robert H. Webb, U.S. Geological Survey, Stake 2254d, 2254c, 2254b, 2254a.)

Panorama of Paria Canyon Upstream from Lonely Dell Ranch



1872

A



May 25, 1992

A

Photograph site 2.

1872, A. To get a better view of Paria Canyon upstream from Lonely Dell Ranch, William Bell moved his camera slightly on the Pleistocene terraces and took panning views downstream. In this horizontal format view, Bell shows two levels of Pleistocene terraces (left foreground; units gvc and gvd) overlying the Moenkopi Formation (unit $\overline{\text{Fm}}$). Cottonwood trees grow along the channel, which flows right to left across the midground, then turns to join the Colorado River. In the distance, the channel of the Paria River is obscured behind a dense grove of willows. A solitary horse (circle) is on the floodplain at right center. (*Photograph by William A. Bell, courtesy of the National Archives, 273.*) **May 25, 1992, A.** Many of the rocks on the prehistoric debris fan (unit dfp) in the foreground are in the same place 120 years later. The channel of the Paria River appears to be wider and deeper, and the amount of riparian vegetation appears to have decreased in the view. The prehistoric terrace (unit pt) beyond the Paria River channel was intensively farmed in the late 1800s to early 1900s; it appears barren compared with the vegetation cover present in 1872. Tamarisk appears to be far more abundant than native willow, and cottonwood appears much larger although less numerous than in 1872. (*Photograph by Robert H. Webb, U.S. Geological Survey, Stake 2255a.*)

Panorama of Paria Canyon Upstream from Lonely Dell Ranch—Continued

1872



B

May 25, 1992



B

Photograph site 2.—Continued

1872, *B*. In this vertical-format downstream view, Bell's photograph captures the image of the Paria River as it leaves the west bedrock wall and crosses the valley (right to left). John D. Lee's house, built the year before Bell arrived, appears as a low shack in the right center (circle). An irrigation ditch on the prehistoric terrace (unit pt) appears prominently in the view. It was built by John D. Lee and leads upstream to his first dam just off the right margin of the photograph. The channel of the Paria River, lined with small cottonwoods and shrubs that are probably seep willow (*Baccharis* sp.), appears incised below the prehistoric terrace. A gully on the prehistoric debris fan (unit dfp) in the midground appears scoured as if a recent flood had eroded the channel. (*Photograph by William A. Bell, courtesy of the National Archives, 589.*) **May 25, 1992, *B*.** The modern terrace (unit mt) of the Paria River channel, marked by scattered cottonwood mixed with tamarisk, appears to be wider than the settlement-age floodplain of 1872. Lee's house has been replaced by the Lonely Dell compound, which consists of a number of buildings, orchards, and cultivated cottonwood trees. A permanent road and two irrigation ponds were constructed in the intervening years. The gully across the midground appears subdued and is partly filled with sediment. (*Photograph by Robert H. Webb, U.S. Geological Survey, Stake 2255c.*)

Overview of Lonely Dell Ranch and Junction with the Colorado River



1910



November 11, 1999

Photograph site 3.

1910. Charles H. Spencer attempted to mine the Chinle Formation for gold beginning in 1910. Albert Jones, who worked for Spencer, took this south-facing photograph of the Lonely Dell Ranch and Paria River delta. At the time of the photograph, the mouth of the Paria River was on the upstream side of the delta. The channel is wide and relatively deep, and the vertical banks may be the legacy of the 1909 flood (fig. 4 and table 2 on map) of the Paria River. With the exception of the delta area, the channel is free of riparian vegetation, and only scattered cottonwoods appear along the banks. On the delta, native willow and arrowweed (*Tessaria sericea*) dominate the floodplain, which is the younger terrace (unit yt) of the Colorado River. The photograph was taken during the annual flood of the Colorado River (May–June), which is backed up into the Paria River. The center of the photograph shows the fields and orchards of Lonely Dell Ranch. The road crossing the fields led to the Paria River crossing and Lees Ferry. (Photograph by Albert H. Jones, courtesy of the P.T. Reilly Collection, Cline Library, Northern Arizona University.) **November 11, 1999.** The channel of the Paria River has narrowed, shifted, and aggraded with deposits of the modern alluvium, as this photograph and several that follow show. Almost directly below the camera position, a gaging station was installed in 1923 to record streamflow of the Paria River. Willow and tamarisk form a nearly continuous line on both banks; a few new cottonwood trees have become established. Willow is now scarce in the delta area, replaced by tamarisk and arrowweed. One Mormon tea bush (*Ephedra torreyana*) persists in the rocks at lower left. (Photograph by Robert H. Webb, U.S. Geological Survey, Stake 3989.)

Overview of Lonely Dell Ranch and Junction with the Colorado River—Continued



1921



May 5, 1994

Photograph site 4.

1921. Taken by the Kolb brothers, this view is from a similar vantage point as photograph site 3. In 1912, the mouth of the Paria River shifted to below the delta; by 1921 the upper channel was silted in partly by deposition of the alluvium of the younger terrace (unit yt) and was covered by a dense thicket of willow and arrowweed. As seen in the lower left, the channel of the Paria River shifted to the southeast since 1910, eroding Holocene talus (unit ts) and the intermediate terrace (unit it), continuing a pattern that began after 1872 (see Timothy O’Sullivan’s 1873 photograph, photograph site 11, and Franklin A. Nims 1889 photograph, photograph site 12). Lonely Dell Ranch is in the shadows at lower right. (*Photograph by the Kolb Brothers 568-676, courtesy of the Cline Library, Northern Arizona University.*) **May 5, 1994.** As shown in photograph site 3, the channel of the Paria River has narrowed through deposition of the modern alluvium; a dense stand of tamarisk and willow lines both banks. The difference in stature between native willow and non-native tamarisk is particularly apparent in a comparison of the left midground, where the Paria River channel trends away from the eastern cliff. The buildings just above this area are National Park Service facilities constructed on the younger terrace (unit yt) since 1963. (*Photograph by Dominic Oldershaw, Stake 2854.*)

Channel of the Paria River at and near the Gaging Station



ca. 1964–1968

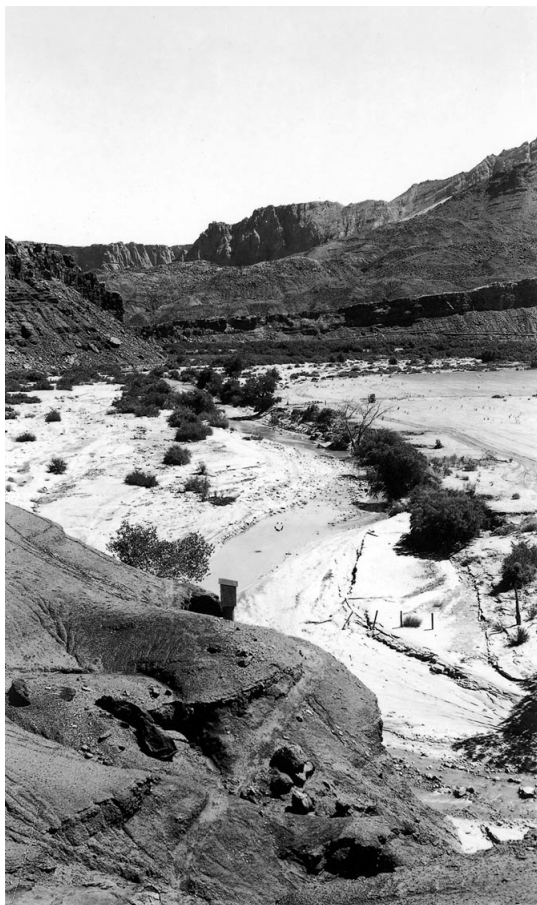


January 19, 1984

Photograph site 5. View upstream

ca. 1964–1968. This upstream view shows channel conditions in the reach just west of the gaging station. A small cottonwood tree appears at right center, just right of a relatively straight channel reach that undoubtedly was used for indirect-discharge estimates. The metal A-frame at left is the channel-left anchor for a cableway that allowed discharge measurements at flows higher than can be safely waded. The shrubs on both sides of the river are tamarisk. (*Photographer unknown, courtesy of the U.S. Geological Survey.*) **January 19, 1984.** Although the camera is a little too close to the foreground boulder, making this an inexact match, there is no doubt that the channel of the Paria River has changed. The cottonwood tree has been eliminated, probably during one of the floods that have swept down the Paria River since the original photograph. The numerous berms on the modern terrace (unit mt) and steep cutbank on the prehistoric terrace (unit pt; river right) formed during floods in 1980. (*Photograph by Richard Hereford, U.S. Geological Survey, Stake 1379.*)

Channel of the Paria River at and near the Gaging Station—Continued



ca. 1964–1968



January 19, 1984

Photograph site 5. View downstream

ca. 1964–1968. As part of routine gaging station maintenance, a hydrologic-technician took this downstream photograph from a point above and just upstream of the gaging station. The gage house and the top of the stilling well are visible at left center. The modern floodplain is relatively open at this time and the channel banks are smooth with gradual slopes. (*Photographer unknown, courtesy of the U.S. Geological Survey.*) **January 19, 1984.** The modern terrace (unit mt) dominates this view. The camera station is a little to the left of the original, nonetheless several significant changes are visible in a minimum of 16 years between the photographs. A small cottonwood has died; the dead branches are barely visible. Tamarisk and willow have increased along the channel margin, particularly on the right side. The channel has also widened slightly and the former floodplain was scoured on river right across from the gaging station during floods of 1980, producing a near-vertical bank. (*Photograph by Richard Hereford, U.S. Geological Survey, Stake 1381.*)

Channel of the Paria River at and near the Gaging Station



ca. 1964–1968



January 19, 1984

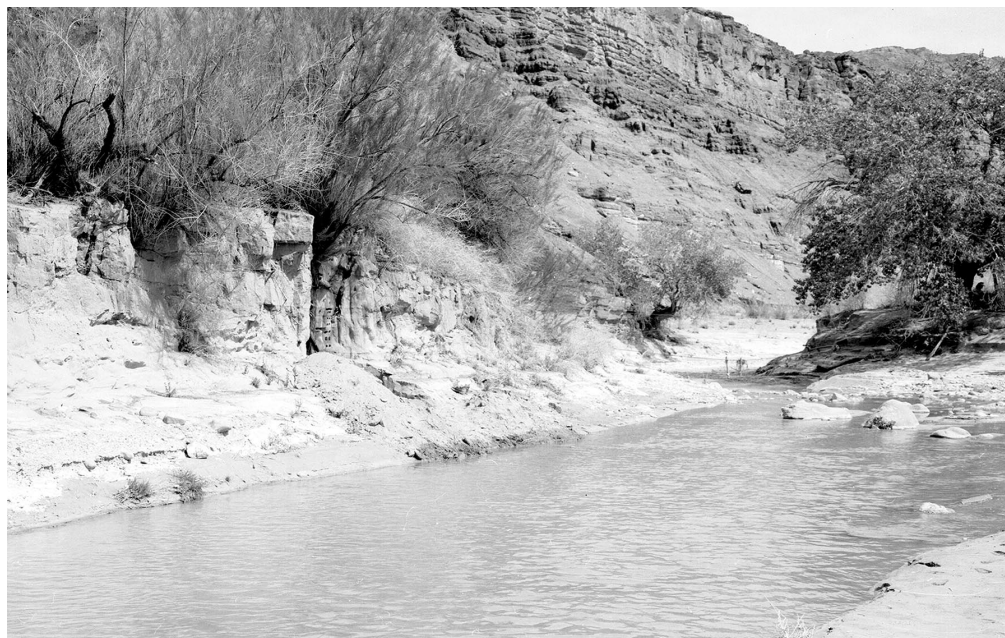
Photograph site 6.

ca. 1964–1968. Operation of a gaging station requires establishment of topographical control in nearby straight, relatively uniform reach to allow indirect-discharge estimates. This downstream view to the south is such a reach. Although we have no evidence to support the exact date of the photograph, we speculate that it was taken in September 1963 after a relatively large flood. The purpose of the photograph was probably to document channel-roughness estimates for the right bank. (*Photographer unknown, courtesy of the U.S. Geological Survey.*) **January 19, 1984.** At least 16 years later (and probably 21 years later), vegetation has grown on the scoured surface of the modern terrace (unit mt) and the channel has shifted towards the left. Almost all the vegetation in the foreground is non-native, including Russian thistle (*Salsola iberica*) in the foreground and tamarisk at left and center midground. Compare these photographs with photograph site 7, which is closer to the gaging station. (*Photograph by Richard Hereford, U.S. Geological Survey, Stake 1382b.*)

Channel of the Paria River at and near the Gaging Station—Continued



October 1939



April 19, 1991

Photograph site 7.

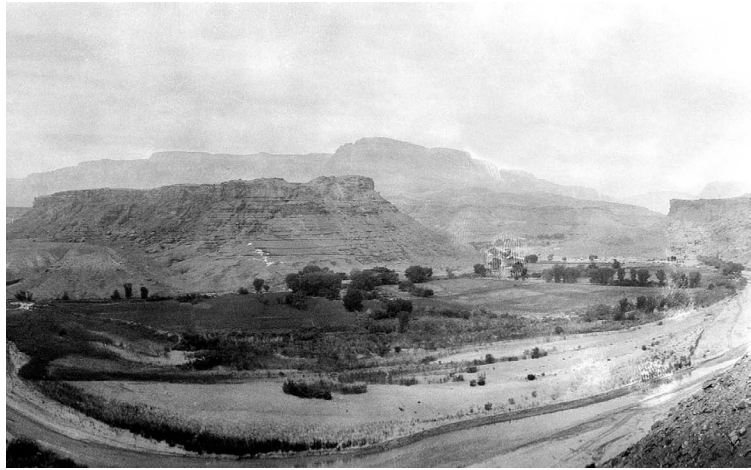
October 1939. The Paria River gaging station was in a barren reach in 1939. This downstream view was taken to document channel conditions, which were needed to make indirect discharge estimates. Small cottonwoods appear on right side of the channel (right midground). (*Photograph by W.T. Stuart, Stake 2679, courtesy of the U.S. Geological Survey.*) **April 19, 1991.** The gaging station is not visible, owing to deposition of 3–4 m of modern alluvium. Hereford (1986) discusses this site. Deposition of this sediment began after 1939, the year of the original photograph. The channel has narrowed considerably and then deepened after the floods of 1980 (table 2 on map sheet). One of the cottonwoods is still present and the tamarisk are rooted in the modern alluvium. (*Photograph by Sara Light, Stake 1781.*)

Downstream Panoramic View of the Mouth of the Paria River



September 1, 1915

A



B



November 11, 1999

A

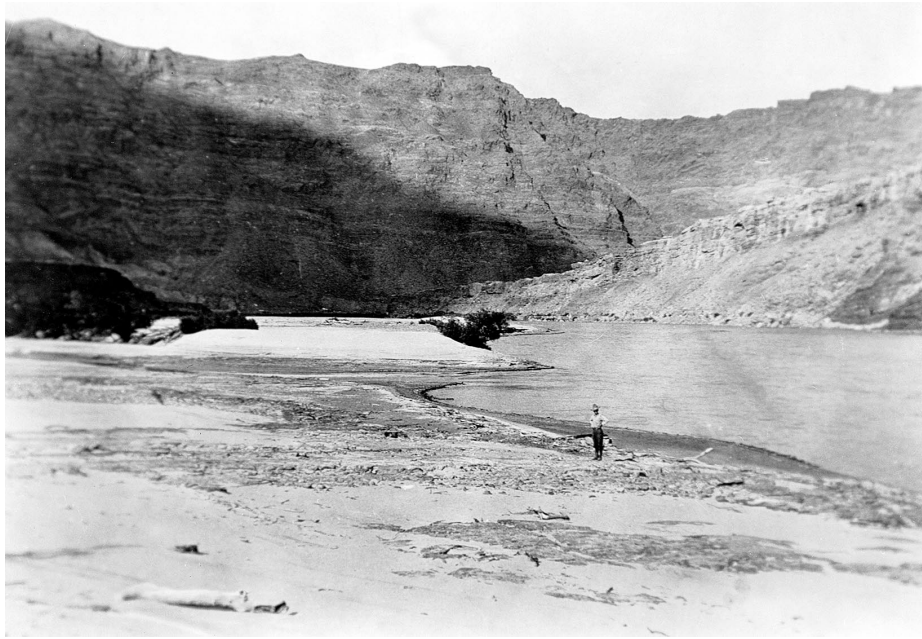


B

Photograph site 8.

September 1, 1915. Eugene C. LaRue used panoramic cameras to document the rivers he studied. LaRue photographed much of the Green and Colorado River systems between 1914 and 1923. He wanted to build a large dam on the Colorado River about 5 mi upstream from this site; he died seven years before the Colorado River Storage Project, with Glen Canyon Dam as its flagship, was enacted by Congress in 1956. This southwest-facing panoramic vista across Lonely Dell Ranch and the Paria River delta shows detailed conditions of the site in 1915, only three years after the mouth of the Paria shifted downstream below the delta. This avulsion (documented in Herbert E. Gregory's June 5, 1915 photograph, photograph site 11) was caused by the Colorado River flood of the previous spring and is prominent in the view *A* midground. The Paria River, which flows from right to left, has a broad, nearly denuded channel in the view *B* foreground. Vertical banks mark its right bank at lower right. (*Photograph by Eugene C. LaRue, 299, courtesy of the U.S. Geological Survey Photographic Library.*) **November 11, 1999.** Many geomorphic and ecologic changes are apparent in this comparison. First, the Paria River has narrowed its channel considerably because of deposition of the modern alluvium. Possibly in response to this deposition, the channel appears to be deeper than in 1915. The center of the channel has shifted slightly to the left, and riparian vegetation has encroached on the formerly wide channel, filling in the formerly denuded (view *B*) terrace, which is the historic terrace (unit ht). The riparian vegetation has changed from mostly willow and arrowweed to dense growths of tamarisk with willow along the channel margin. (*Photograph by Dominic Oldershaw, Stake 3990.*)

Channel of the Colorado River at and near the Mouth of the Paria River



1923



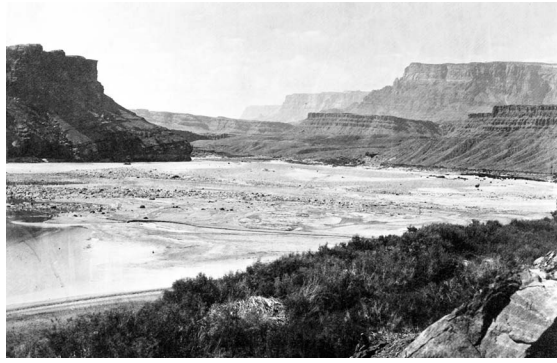
December 30, 1991

Photograph site 9.

1923. Just before the start of a Grand Canyon expedition in August 1923, LaRue captured this northeast-facing view of the mouth of the Paria River to demonstrate low flow conditions. Large sandbars mantle the north bank of the Colorado River and the riparian vegetation in the distance is probably seep willow. (*Photograph by Eugene C. LaRue, 328, courtesy of the U.S. Geological Survey Photographic Library.*) **December 30, 1991.** Tamarisk now blocks the view. Tamarisk was introduced into the Paria River basin in 1870 by George Adair, who planted cuttings in Adairville, 50 km upstream of the Lonely Dell area. As noted in a biological survey, tamarisk was present but uncommon in 1938 at Lees Ferry. After closure of Glen Canyon Dam in 1963, tamarisk increased dramatically at Lees Ferry. (*Photograph by Jim Hasbargen, Stake 2069.*)

Channel of the Colorado River at and near the Mouth of the Paria River

1873



June 27, 1972



May 6, 1994



Photograph site 10.

1873. Timothy O’Sullivan was the photographer for the Wheeler Expedition in 1871 and 1873, with Bell filling the position in 1872. After an overland trip to Lees Ferry from Canyon de Chelly, O’Sullivan photographed the Colorado River and Paria River delta at Lees Ferry. This view, looking southwest down the Colorado River at the Paria Riffle and delta, shows the very wide channel of the river that is devoid of riparian vegetation. The vegetation present in the foreground, which is most likely arrowweed, is on what was then the floodplain of the intermediate terrace (unit it). Note the piles of driftwood among the foreground plants. (*Photograph by Timothy H. O’Sullivan, 339, courtesy of the National Archives.*)

June 27, 1972. A road to the boat-launching ramp at Lees Ferry crosses the intermediate terrace (unit it) in the foreground. A lower cable, shown over the water at the extreme left, is for the gaging station on the Colorado River at Lees Ferry. In his interpretation (Turner and Karpiscak, 1980), Turner noted the conversion from native vegetation, which he interpreted as “probably rabbitbrush (*Chrysothamnus* sp.),” to a mixture of seep willow, arrowweed, and tamarisk. The tamarisk is on the topographically lower terrace of the pre-dam alluvium (unit pda). (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 671.*) **May 6, 1994.** The density of low shrubs on the intermediate terrace (unit it) has increased considerably, probably in response to less disturbance associated with the road. A fire swept through the dense tamarisk at left in the early 1980s, leaving many dead trees. Unfortunately, tamarisk responds positively to fire, and most of the re-growth shown is tamarisk. The formerly prominent delta is now difficult to see because of the dense tamarisk grove on its surface and the higher banks. (*Photograph by Dominic Oldershaw, Stake 671.*)

Delta and Mouth of the Paria River from the South Bank of the Colorado River



1873



August 22, 1972

Photograph site 11.

1873. Timothy O'Sullivan, in one of his most famous photographs, documented the mouth of the Paria River in 1873. This view looking north-northwest into Paria River Canyon shows scattered cottonwood and willow in the channel of the Paria River (Turner and Karpiscak, 1980) growing on what was then the intermediate-age floodplain of the Colorado River. John D. Lee's cabin appears in the midground at the left (circle). (*Photograph by Timothy H. O'Sullivan, 348, courtesy of the National Archives.*) **August 22, 1972.** About 1912, the mouth of the Paria River shifted downstream to below the delta, and the former mouth filled in with sediment, mostly from the Colorado River. The vegetation is mainly tamarisk and seep willow. John D. Lee's former ranch supports a luxuriant growth of cultivated cottonwood and fruit trees. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 706.*)

Delta and Mouth of the Paria River from the South Bank of the Colorado River—Continued



June 5, 1915



August 22, 1972

Photograph site 11.—Continued

June 5, 1915. Herbert E. Gregory, a pioneering geologist in the region, came to Lees Ferry as a part of a survey of the Paria River basin. As his predecessors did, Gregory took a photograph (facing west-northwest) of the mouth of the Paria River and Lonely Dell Ranch. The Colorado River, in full flood, has carved a channel through the delta and into the channel of the Paria River, which had only shifted downstream three years before Gregory's visit. The vegetation is mostly seep willow and arrowweed, with cottonwood trees around Lonely Dell and upstream on the Paria River. (*Photograph by Herbert E. Gregory, 285, courtesy of the U.S. Geological Survey Photographic Library.*) **August 22, 1972.** The Colorado River no longer floods as frequently as it did in the period when Gregory visited. Glen Canyon Dam, which closed its gates nine years before this photograph was taken, greatly affected the Colorado River. One of the largest changes has been the increase in riparian vegetation along the margin of the river; in this scene, non-native tamarisk has replaced the native willows and arrowweed. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 708a.*)

Delta and Mouth of the Paria River from the South Bank of the Colorado River—Continued



June 6, 1915



August 22, 1972

Photograph site 11.—Continued

June 6, 1915. Gregory photographed this view of the gently dipping Shinarump Member of the Chinle Formation (unit Tcs) along the northwest strike of the Echo Cliffs monocline. The low riparian vegetation is mostly seep willow and arrowweed. (*Photograph by Herbert E. Gregory, 286, courtesy of the U.S. Geological Survey Photographic Library.*) **August 22, 1972.** At the time of this photograph, tamarisk dominated the floodplain vegetation. The gaging station on the Colorado River at Lees Ferry is just upstream of this camera station. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 708b.*)

Delta and Mouth of the Paria River from the South Bank of the Colorado River—Continued



June 6, 1915



August 22, 1972

Photograph site 11.—Continued

June 6, 1915. H.E. Gregory's southwest-facing downstream view from a camera position near that of F.L. Ransome's ca. 1920 photograph shows the Colorado River in flood. The discharge is high enough that the large talus block (see Ransome's ca. 1920 photograph) in the center of the Colorado River is covered. A thin band of riparian vegetation, probably seep willow, marks the distant mouth of the Paria River. Sand mantles the delta area. (*Photograph by Herbert E. Gregory, 287, courtesy of the U.S. Geological Survey Photographic Library.*) **August 22, 1972.** Most of the sand has been stripped from the surface of the delta, particularly near the river. Scattered shrubs and willows are on the surface of the delta, and a dense line of tamarisk marks the channel of the Paria River in the background. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 709.*)

Delta and Mouth of the Paria River from the South Bank of the Colorado River—Continued

ca. 1920



August 22, 1972



December 20, 1989



Photograph site 11.—Continued

ca. 1920. F.L. Ransome was a geologist with the U.S. Geological Survey interested in mineral deposits in the region. Possibly because of Charles Spencer's claims that the Chinle Formation at Lees Ferry contained recoverable gold, Ransome visited the site and took several photographs. This view looking downstream shows the barren delta of the Paria River. (*Photograph by F.L. Ransome, 1359, courtesy of the U.S. Geological Survey Photographic Library.*) **August 22, 1972.** The delta remains mostly barren despite the large increase in tamarisk elsewhere at Lees Ferry. The light-colored deposits are active sand dunes (unit ea). The coarse gravel substrate of the delta may minimize the ability of tamarisk to colonize the site. A dense line of tamarisk appears on the edge of the delta in the background. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 707a.*) **December 20, 1989.** Riparian vegetation, primarily tamarisk, has increased in the center of the delta as well as along the Paria River at the base of the background hills. The spoil piles of several gravel pits are present in the midground. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 707a.*)

Delta and Mouth of the Paria River from the South Bank of the Colorado River—Continued



ca. 1920



August 22, 1972



December 20, 1989

Photograph site 11.—Continued

ca. 1920. In Ransome's view of the mouth of the Paria River, the Lees Ferry ranch buildings are on the left. The mouth of the Paria had shifted downstream several years before Ransome's visit, and its former location is covered with willows and arrowweed growing on what was then the younger floodplain (unit yt) of the Colorado River. (*Photograph by F.L. Ransome, 1360, courtesy of the U.S. Geological Survey Photographic Library.*) **August 22, 1972.** In the foreground, a dense stand of tamarisk became established on the pre-dam alluvium (unit pda) on river right, primarily after closure of Glen Canyon Dam in 1963. The dense riparian vegetation at the mouth of the Paria River belies the arid climate of the site. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 707b.*) **December 20, 1989.** A fire in the early 1980s killed most of the tamarisk on river right, once again providing a view of the river terrace (unit pda). This tamarisk has since re-grown to nearly its former density. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 707b.*)

Delta and Mouth of the Paria River from the South Bank of the Colorado River—Continued



December 28, 1889



December 20, 1989

Photograph site 12.

December 28, 1889. In 1889, Franklin Nims, photographer for the Denver, Colorado & Pacific Railroad Company, photographed the mouth of the Paria River. His camera position was similar to that of O'Sullivan's 1873 photograph 16 years earlier (photograph site 11, p. 14), although Nims used a wide angle lens. Between 1872–1889, the intermediate terrace (unit it) was incised by a southeast shift of the Paria River, probably during one or more Paria River floods, as shown by the cutbank in the right midground. Generally, the channel of the Paria appears wider and deeper. (*Photograph by Franklin A. Nims, 261, courtesy of the National Archives.*) **December 20, 1989.** The stage of the Colorado River is higher than in 1889, covering the delta area shown in the 1889 photograph. The vegetation, on river right, in the midground is mostly tamarisk on the pre-dam alluvium (unit pda). The grove burned in the early 1980s, shortly before this photograph was taken. The tamarisk has since re-grown around the dead trees. (*Photograph by Raymond M. Turner, U.S. Geological Survey, Stake 1396.*)

Delta and Mouth of the Paria River from the South Bank of the Colorado River—Continued



December 28, 1889



February 11, 1992

Photograph site 13.

December 28, 1889. Nims photographed the Paria Riffle and delta from Lees Backbone (northeast-facing view). Nims photograph is murky because he used paper-stripping film, which consisted of emulsion backed with butcher paper. The paper had to be coated with oil to render the image translucent enough for printing. The mouth of the Paria River is prominent on the left side and appears to have been flooded just before this photograph was taken. (*Photograph by Franklin A. Nims, 269, courtesy of the National Archives.*) **February 11, 1992.** This part of the delta, which is occasionally flooded by releases from Glen Canyon Dam, is now mostly gravel (unit gv) overlain in places by eolian sand (unit ea) and is barren of riparian vegetation. The Paria Riffle has not changed significantly; note the large rock in the center of the riffle at lower left. Several Mormon tea bushes on the Lees Backbone have persisted over the 103 years between photographs. The camera station is outside of the mapped area. (*Photograph by Theodore S. Melis, U.S. Geological Survey, Stake 2562.*)

